

R309-545 Facility Design and Operation: Drinking Water Storage Tanks

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R309-545. Facility Design and Operation: Drinking Water Storage Tanks.

R309-545-1. Purpose.

The purpose of this rule is to provide specific requirements for public drinking water storage tanks. It is intended to be applied in conjunction with other rules, specifically R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

R309-545-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

R309-545-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-545-4. General.

Storage for drinking water shall be provided as an integral part of each public drinking water system unless an exception to rule is approved by the Director. Pipeline volume in transmission or distribution lines shall not be considered part of any storage volumes.

R309-545-5. Size of Tank(s).

Required Storage Capacity: In the absence of firm water use data, at or above the 90% confidence level, storage tanks shall be sized in accordance with the required minimums of R309-510.

Guidance: *The storage requirements in R309-510 may be reduced or eliminated when the source and any treatment facility have sufficient capacity and reliability (e.g. dual pumps, standby power, etc.) to serve the peak hourly demands of the system plus fire flows. A request for an exception from rule, as described in R309-105-6(2)(b), shall be submitted along with records supporting the request and the exception approved, in writing, by the Director before storage can be reduced or eliminated.*

R309-545-6. Tank Material and Structural Adequacy.

(1) Materials.

The materials used in drinking water storage structures shall provide stability and durability as well as protect the quality of the stored water. Steel tanks shall be constructed from new, previously unused, plates and designed in accordance with AWWA Standard D-100.

(2) Structural Design.

The structural design of drinking water storage structures shall be sufficient for the environment in which they are located. The design shall incorporate a careful analysis of potential seismic risks.

Guidance: Division review of plans and specifications for storage tanks does not include an evaluation of structural suitability. Certificate of structural adequacy may be requested from the design engineer before approval is granted.

R309-545-7. Location of Tanks.

(1) Pressure Considerations.

The location of the reservoir and the design of the water system shall be such that the minimum working pressure in the distribution system shall meet the minimum pressures as required in R309-105-9.

Guidance: The normal working pressure shall be between 40 and 60 psi. When static pressures exceed 80 psi, pressure reducing devices shall be provided on mains in the distribution system, or individual home pressure reducing valves shall be installed per the Utah Plumbing Code. The expected water level variation in the tank shall be taken into account when considering minimum and maximum distribution system pressures.

(2) Connections.

Tanks shall be located at an elevation where present and anticipated connections can be adequately served. System connections shall not be placed at elevations such that minimum pressures as required in R309-105-9 cannot be continuously maintained.

(3) Sewer Proximity.

Sewers, drains, standing water, and similar sources of possible contamination shall be kept at least 50 horizontal feet from the reservoir.

(4) Standing Surface Water.

The area surrounding a ground-level drinking water storage structure shall be graded in a manner that will prevent surface water from standing within 50 horizontal feet of the

structure.

(5) Ability to Isolate.

Drinking water storage structures shall be designed and located so that they can be isolated from the distribution system. Storage structures shall be capable of being drained for cleaning or maintenance without necessitating loss of pressure in the distribution system.

Guidance: It is recommended that any discharge lines from tank overflow or drains be sloped for complete drainage so as to prevent any standing water in these lines. It is also recommended that these lines be separate from each other as well as separate from other discharge lines, such as from perimeter french drain system, and each be easily visible as required for the overflow line.

(6) Earthquake and Landslide Risks.

Potential geologic hazards shall be taken into account in selecting a tank location. Earthquake and landslide risks shall be evaluated.

Guidance: The design may include special shut-off or isolation valves designed to react in the event of an earthquake.

(7) Security.

The site location and design of a drinking water storage reservoir shall take into consideration security issues and potential for vandalism.

R309-545-8. Tank Burial.

(1) Flood Elevation.

The bottom of drinking water storage reservoirs shall be located at least three feet above the 100 year flood level or the highest known maximum flood elevation, whichever is higher.

Guidance: The bottom shall be placed at the normal ground surface when ever possible.

(2) Ground Water.

When the bottom of a drinking water storage reservoir is to be below normal ground surface, it shall be placed above the local ground water table elevation.

Guidance: It is recommended that a french drain system be considered around any buried storage tank, but especially if the ground water table elevation is unknown or may exhibit seasonal variations.

(3) Covered Roof.

When the roof of a drinking water storage reservoir is to be covered by earth, the roof shall be sloped to drain toward the outside edge of the tank.

R309-545-9. Tank Roof and Sidewalls.

(1) Protection From Contamination.

All drinking water storage structures shall have suitable watertight roofs and sidewalls which shall also exclude birds, animals, insects, and excessive dust.

(2) Openings.

Openings in the roof and sidewalls shall be kept to a minimum and comply with the following:

(a) Any pipes running through the roof or sidewall of a metal drinking water storage structure shall be welded, or properly gasketed. In new concrete tanks, these pipes shall be connected to standard wall castings with seepage rings which have been poured in place. Vent pipes, in additions to seepage rings, shall have raised concrete curbs which direct water away from the vent pipe and are formed as a single pour with the roof deck. No roof drains or any other pipes which may contain water of less quality than drinking water shall ever penetrate the roof, walls, or floor of a drinking water storage tank.

(b) Openings in a storage structure roof or top, designated to accommodate control apparatus or pump columns, shall be welded, gasketed, or curbed and sleeved as above, and shall have additional proper shielding to prevent vandalism.

Guidance: Valves and controls shall be located outside the storage structure so that the valve stems and similar projections will not pass through the roof or top of the reservoir.

(c) Openings shall be kept as far away as possible from the storage tank outlet and other sources of surface water.

(3) Adjacent Compartments.

Drinking water shall not be stored or conveyed in a compartment adjacent to wastewater when the two compartments are separated by a single wall.

(4) Slope of Roof.

The roof of all storage structures shall be designed for drainage. Parapets, or similar construction which would tend to hold water and snow, shall not be utilized unless adequate waterproofing and drainage are provided. Downspout or roof drain pipes shall not enter or pass through the reservoir.

R309-545-10. Internal Features.

Guidance: A means shall be provided for the draining of drinking water storage structures that is separate from the normal outlet pipeline. The floor of the storage structure shall be sloped to permit complete drainage of the structure. Also the maximum variation between high and low water levels in storage structures, providing pressure to a distribution system, shall not exceed 30 feet.

The following shall apply to internal features of drinking water storage structures:

(1) Drains.

If a drain is provided, it shall not discharge to a sanitary sewer. If local authority allows discharge to a storm drain, the drain discharge shall have a physical air gap of at least two pipe diameters between the discharge end of the pipe and the overflow rim of the receiving basin.

(2) Internal Catwalks.

Internal catwalks, if provided and located so as to be over the drinking water, shall have a solid floor with raised edges. The edges and floor shall be so designed that shoe scrapings or dirt will not fall into the drinking water.

(3) Inlet and Outlet.

To minimize potential sediment flow from the structure, the normal outlet pipes from all reservoirs shall be located in a manner to provide a silt trap prior to discharge into the distribution system.

Guidance: Where separate drains are not provided, removable silt stops shall be provided on reservoir discharge pipes.

(4) Disinfection.

If the drinking water reservoir is to be utilized as a contact basin for disinfection purposes, the design engineer shall conduct tracer studies or other tests, previously approved by the Director, to determine the minimum contact time and the potential for short circuiting.

Guidance: In order to minimize short circuiting and to maximize the effectiveness of any disinfection process, inlet and outlet pipes shall be as distant from one another as possible. Internal baffling may also be needed in order to minimize the possibility of short circuiting through the tank.

R309-545-11. ANSI/NSF International, Standard 61.

(1) ANSI/NSF Standard 61 Certification.

All interior surfaces or coatings shall consist of products which are certified by laboratories approved by ANSI and which comply with ANSI/NSF Standard 61 or other standards approved by the Director. This requirement applies to any pipes and fittings, protective materials (e.g. paints, coatings, concrete admixtures, concrete release agents, concrete sealers), joining and sealing materials (e.g. adhesives, caulks, gaskets, primers and sealants) and mechanical devices (e.g. electrical wire, switches, sensors, valves, submersible pumps) which are located so as to come into contact with the drinking water.

Guidance: If it can be shown to the satisfaction of the Director that flushing, swabbing, cleaning and disinfection procedures will adequately flush a coating (e.g. release agents, curing compounds, etc.) from the tank leaving no residual exceeding any MCL, the Director may accept its use. Prior to placing a drinking water storage reservoir back in service, where products not certified to ANSI/NSF Standard 61 are utilized, the Director may require sampling and testing for a specific compound or ingredient based upon the product used.

(2) Curing Time and Volatile Organic Compounds.

If products which require a cure or set time are utilized in such a way as to come into contact with the drinking water, then water shall not be introduced into the vessel until any required curing time has passed. It shall be the responsibility of the water purveyor to assure that no tastes or odors, toxins or other compounds, which result in MCL exceedances, are imparted to the water as a result of tank repair.

Guidance: Prior to placing a drinking water storage reservoir back in service, an analysis for volatile organic compounds from water contained therein is advisable to establish that no such compounds have leached into the water.

R309-545-12. Steel Tanks.

(1) Paints.

Proper protection shall be given to all metal surfaces, both internal and external, by paints or other protective coatings. Internal coatings shall comply with ANSI/NSF Standard 61.

(2) Cathodic Protection.

If installed, internal cathodic protection shall be designed, installed and maintained by personnel trained in corrosion engineering.

R309-545-13. Tank Overflow.

All water storage structures shall be provided with an overflow which is discharged at an elevation between 12 and 24 inches above the ground surface with an appropriate air gap. The

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discharges shall not cause erosion.

(1) Diameter.

All overflow pipes shall be of sufficient capacity to permit waste of water in excess of the filling rate.

(2) Slope.

All overflow pipes shall Be sloped for complete drainage,

(3) Screen.

All overflow pipes shall be screened with No. 4 mesh non-corrodible screen installed at a location least susceptible to damage by vandalism,

(4) Visible Discharge.

All overflow pipes shall be located so that any discharge is visible,

(5) Cross Connections.

All overflow pipes shall not be connected to, or discharge into, any sanitary sewer system.

(6) Paint.

If an overflow pipe within a reservoir is painted or otherwise coated, such coating shall comply with ANSI/NSF Standard 61.

R309-545-14. Access Openings.

Drinking water storage structures shall be designed with reasonably convenient access to the interior for cleaning and maintenance.

Guidance: When considering what is reasonably convenient, the design engineer shall consider that it may be necessary for one individual to open the access. The access shall be hinged at one side, and counter-weighted if the lid is in excess of 60 pounds.

(1) Height.

There shall be at least one opening above the water line which shall be framed at least four inches above the surface of the roof at the opening; or if on a buried structure, shall be elevated at least 18 inches above any earthen cover over the structure. The frame shall be securely fastened and sealed to the tank roof so as to prevent any liquid contaminant entering the tank. Concrete drinking water storage structures shall have raised curbs around access openings, formed and poured continuous with the pouring of the roof and sloped to direct water away from the frame.

Guidance: It is preferable that access openings be framed higher than the four inches

required above, and if located in areas subject to heavy snows, be more in the area of 24 to 36 inches.

(2) Shoebox Lid.

The frame of any access opening shall be provided with a close fitting solid shoebox type cover which extends down around the frame at least two inches and is furnished with a gasket(s) between the lid and frame,

Guidance: By “solid” the Division means having no opening, cracks or other penetrations of the lid which could allow liquid contaminants to enter the tank. Designers wishing to utilize pre-manufactured roof shutters as access lids for drinking water storage structures shall contact the distributor of such and make clear that any penetrations through the lid is not acceptable.

(3) Locking Device.

The lid to any access opening shall have a locking device.

R309-545-15. Venting.

Drinking water storage structures shall be vented. Overflows shall not be considered as vents. Vents provided on drinking water storage reservoirs shall:

(1) Inverted Vent.

Be downturned a minimum of two inches below any opening or shielded to prevent the entrance of surface water and rainwater.

(2) Open Discharge.

On buried structures, have the discharge a minimum of 24 inches above the earthen covering.

(3) Blockage.

Be located and sized so as to avoid blockage during winter conditions.

(4) Pests.

Exclude birds and animals.

(5) Dust.

Exclude insects and dust, as much as this function can be made compatible with effective venting.

(6) Screen.

Be fitted with No. 14 mesh or finer non-corrodible screen.

(7) Screen Protector.

Be fitted with additional heavy gage screen or substantial covering which will protect the No. 14 mesh screen against vandalism and, further, discourage purposeful attempts to contaminate the reservoir.

R309-545-16. Freezing Prevention.

All drinking water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing which may interfere with proper functioning.

R309-545-17. Level Controls.

Adequate level control devices shall be provided to maintain water levels in storage structures.

R309-545-18. Security.

Locks on access manholes, and other necessary precautions shall be provided to prevent unauthorized entrance, vandalism, or sabotage.

Guidance: Fencing is advisable where the reservoir is highly accessible to the public or livestock. Where electricity or telemetry is available, consideration shall be given to the installation of electronic security equipment.

R309-545-19. Safety.

(1) Utah OSHA.

The safety of employees shall be considered in the design of the storage structure. Ladders, ladder guards, platform railings, and safely located entrance hatches shall be provided where applicable. As a minimum, such matters shall conform to pertinent laws and regulations of the Utah Occupational Safety and Health Administration.

(2) Ladders.

Generally, ladders having an unbroken length in excess of 20 feet shall be provided with appropriate safety devices. This requirement shall apply both to interior and exterior reservoir ladders.

(3) Requirements for Elevated Tanks.

Elevated tanks shall have railings or handholds provided for transfer from the access tube

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to the water compartment.

R309-545-20. Disinfection.

Drinking water storage structures shall be disinfected before being put into service for the first time, and after being entered for cleaning, repair, or painting. The reservoir shall be cleaned of all refuse and shall then be washed with potable water prior to adding the disinfectant. AWWA Standard C652-02 shall be followed for reservoir disinfection, with the exception there shall be no delivery of waters used in the disinfection process to the distribution system, unless specifically authorized, in writing, by the Director.

Upon completing any of the three methods for storage tank chlorination, as outlined in AWWA C652-02, the water system must properly dispose of residual super-chlorinated waters in the outlet pipes. Other super-chlorinated waters, which are not to be ultimately diluted and delivered into the distribution system, shall also be properly disposed.

Guidance: The Director may require sampling and analysis of water prior to authorizing it's delivery into a distribution system.

Chlorinated water discharged from the storage tank shall be disposed of in an acceptable manner and in conformance with the rules of the Utah Water Quality Board (see R317 of the Utah Administrative Code).

R309-545-21. Incorporation by Reference.

The following list of Standards shall be considered as incorporated by reference in this specific rule. The most recent published copy of the referenced standard will apply in each case.

(1) AWWA Standards.

- (a) C652-02, Disinfection of Water Storage Reservoirs.
- (b) D100-05, Welded Steel Tanks for Water Storage.
- (c) D101-53(R86), Inspecting and Repairing Steel Water Tanks, Standpipes, Reservoirs, and Elevated Tanks for Water Storage.
- (d) D102-03, Coating Steel Water-Storage Tanks.
- (e) D103-97, Factory-Coated Bolted Steel Tanks for Water Storage.
- (f) D104-01, Automatically Controlled, Impressed-Current Cathodic Protection for the Interior of Steel Water Tanks.
- (g) D110-04, Wire-Wound Circular Prestressed-Concrete Water Tanks (including addendum D110a-96).
- (h) D115-95, Circular Prestressed Concrete Water Tanks With Circumferential Tendons.
- (i) D120-02, Thermosetting Fiberglass-Reinforced Plastic Tanks.

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(j) D130-02, Flexible-Membrane-Lining and Floating-Cover Materials for Potable-Water Storage.

(2) NSF International Standards.

- (a) NSF 60, Drinking Water Treatment Chemicals - Health Effects.
- (b) NSF 61, Drinking Water System Components - Health Effects.

(3) Utah OSHA.

Applicable standards of the Utah Occupational Safety and Health Administration are hereby incorporated by reference.

R309-545-22. Operation and Maintenance of Storage Tanks.

(1) Inspection and Cleaning.

Tanks which are entered for inspection and cleaning shall be disinfected in accordance with AWWA Standard C652-02 prior to being returned to service. When diver(s) enter storage tanks that have not been drained for inspection purposes, they shall comply with section five of the above standard unless the tank is constructed of steel, in which case they shall comply additionally with AWWA Standard D101-53(R86).

(2) Recoating or Repairing.

Any substance used to recoat or repair the interior of drinking water storage tank shall be certified to conform with ANSI/NSF Standard 61. If the tank is not drained for recoating or repairing, any substance or material used to repair interior coatings or cracks shall be suitable for underwater application, as indicated by the manufacturer, as well as comply with both ANSI/NSF Standards 60 and 61.

(3) Seasonal Use.

Water storage tanks which are operated seasonally shall be flushed and disinfected in accordance with AWWA Standard C652-02 prior to each season's use. Certification of proper disinfection, as evidenced by at least one satisfactory bacteriologic sample, shall be obtained by the system management and kept on file for inspection by personnel of the Division. During the non-use period, care shall be taken to see that openings to the water storage tank (those which are normally closed and sealed during normal use) are closed and secured.

KEY: drinking water, storage tanks, access, overflow and drains

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